

Portland State University
School of Business Administration

PROBLEM SOLVING HANDBOOK

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BA 301 Research and analysis of business problems

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Introduction

Portland State University

Portland State University has received national and international recognition for its integrated and highly-effective approach to undergraduate education. It has been showcased by the American Association of Colleges and Universities and is one of only ten universities nationwide to be selected by the world-renowned Carnegie Foundation to participate in its Integrative Learning Project.

PSU's innovative approaches to learning have also earned notice in the national media. The university has repeatedly been recognized by U.S. News & World Report's annual report on America's Best Colleges for the quality of its academic programs. In fact, the 2006 report "Programs to Look For", which highlights academic programs that lead to student success, placed PSU in excellent company, tied with the University of Michigan and the University of Maryland for first place among all public universities, and tied for first place with Stanford University among all public and private schools in the West.

Key to the university's success has been its ability to provide a learning environment that emphasizes several areas of excellence, including critical thinking, communication, diversity, and social responsibility.

The School of Business Administration

The School of Business Administration's programs build on and expand these strengths, to produce graduates highly valued by regional employers and other stakeholders. The School, of course, has a lot to start with. PSU students bring to their university a unique set of characteristics and strengths. SBA students, in particular, commonly come to the school with a depth and breadth of personal and professional experience that is unequalled in the region. They possess a diversity of backgrounds and knowledge that translate into rich and rigorous classroom discussions.

The School's course on Research and Analysis of Business Problems, BA 301, has been developed to build on these unique student assets. The goal of the course is to sharpen the core competencies and skills of new business graduates as they enter today's challenging and dynamic workplace.

The course enhances core competencies and skills and helps prepare students to make the most of the educational opportunities they will encounter as business majors. Throughout the course, students develop adult learning, critical thinking, and problem solving skills that they can apply to the full range of problems they encounter during their studies at the SBA and, subsequently, in their chosen careers. This Handbook presents the framework and activities that are the basis, in BA 301, for the development of these crucial skills.

The focus of the work in BA 301 is on the development of three core competencies, effectiveness in problem solving, the ability to apply academic theory to practice, and the development of a long-term perspective. These competencies are then applied and sharpened by students as they progress through the SBA core and major courses.

Problem solving

Every graduate of the School must develop excellence in problem-solving capabilities. Through this course and throughout the rest of the business curriculum, students develop the capacity to understand and identify a wide range of common and novel business problems and to follow a systematic approach to solve them effectively. Students at the SBA organize and manage their own work in dealing with a variety of challenging, unstructured problems through numerous assignments, activities, and projects. This extensive practice in problem solving equips SBA students to identify and tackle the challenges they face without the need for detailed guidance from manuals or supervisors.

Theory to practice

The second core competency builds on the first - it is the ability to master theoretical material and apply it to practical, real-world problems. Many of the school's students have workplace and other experiences they bring with them to class to enrich the scope and level of in-class discussions. In addition, throughout their coursework, SBA students work on complex, real-world problems and situations both inside and outside the university. Because they are required to solve problems that take them beyond the confines of textbooks and classrooms, they come to understand the importance of the problem context in working out solutions to complicated problems.

Long-term perspective

Third, students cultivate their ability to see the 'big picture.' They work to become forward-looking thinkers who command an understanding of the economic, social, and natural environments within which business operates. In BA 301 and their other SBA coursework, students become sensitive to the influence of business conditions and the needs of a diverse variety of organizational stakeholders. They develop the capacity to formulate action plans that promote combined goals of long-term economic effectiveness and social responsibility.

Communication, teamwork, initiative

The three core competencies are complemented by three supporting skills that are introduced in the university's general education experiences and strengthened in the business programs. They are: effective verbal and quantitative communication, the ability to lead and work effectively in team settings, and the ability to take initiative, both on the job and off. SBA students practice essential skills in every course they complete. They combine these skills with the core competencies and position themselves as strong and effective contributors in their organizations and communities.

Why this framework?

We all want to be better at solving problems and hundreds of books in business and other fields have been written to help us do it. Almost all of the problem-solving frameworks presented in these books have a few core elements in common: *identifying the problem, generating alternatives, and solving the problem*. So what makes the PSU SBA framework different from the others? And how does the framework help in developing the very competencies and skills that set PSU SBA students apart?

There are obvious and subtle differences between our approach and traditional approaches that make this framework extraordinary. The PSU SBA framework:

- Starts its work before problems arise by focusing attention on the organization's mission and structural factors that influence organizational action.

- Recognizes that not all problems are worth solving - it provides a way to decide which are the real problems today, and to seek out opportunities and threats that affect the future.
- Provides for creativity in generating alternatives, and rigor in analyzing and formulating solutions.
- Considers economic, social, and natural systems consequences for the organization and its stakeholders.
- Recognizes that a good solution is never enough—execution depends on a convincing business case and reasoned implementation.
- Ensures continual improvement through formal evaluation of both outcomes and problem-solving processes.

Following the PSU SBAs comprehensive and systematic approach is not easy. It demands both forward thinking and careful execution. But the care in problem solving is an investment that pays off, both in the immediate consequences of solving the problem, and in the long-term benefits that come from focus and vision.

This handbook presents a complete path through the problem-solving maze, and a working description of each step along the way. But it is a handbook, not a textbook. Gaining problem solving skill requires more of managers than simply reading and thinking about problems. Managers must apply these techniques to both the problems provided in this handbook and to the real and challenging problems in the world beyond the classroom. This handbook is an invitation to do this hard work and bring these problem-solving skills to life.

Managerial Roles and Responsibilities

The core strengths of the SBA are in direct alignment with the capabilities demanded of today's managers. Effective managers take responsibility for their own long-term intellectual growth and the development of their skill sets and capabilities.

Managers spend a great deal of their time at work solving problems. Some problems are predictable and repetitive and can be solved using traditional approaches. Others are challenging, unstructured, and fail to fit themselves to textbook solutions. And new problems are continually presented by developments in the dynamic work environment of today. Addressing difficult problems demands ongoing learning, critical thinking, and a problem-solving approach that requires managers to think about their own problem-solving processes even as they apply them.

Adult learning

Effective problem-solving is a function of both content-area knowledge and problem-solving skill. Modern theories of adult education suggest that adults learn best when the emphasis of the instruction is on the learning process rather than on the content to be learned.

Constructivist learning theory proposes that students don't gain and integrate knowledge solely by reading or listening to information presented to them. In order to master and use this knowledge, they combine new information with past learning to construct and reconstruct their own knowledge. Learning is therefore an active process that requires the learner to engage with the world, by critiquing, integrating, or applying new information. Further, learning is a social activity. Adults solidify and sharpen their understanding through conversations and interactions with others. Finally, knowledge is contextual.

What we learn is influenced by the emotions and learning contexts surrounding the learning experience.

This class takes a constructivist approach, and work in the class is student-driven. The learning takes place within a rich context, reflective of the world beyond the classroom. You will learn about problem-solving by reading about solving problems, writing about solving problems, talking about solving problems, critiquing and refining your own problem solving processes, and by applying problem-solving techniques to a variety of prepared scenarios and real-world problems.

Critical thinking

Critical thinking is the process of using cognitive skills to engage in thinking that is purposeful, rational, and reflexive. Critical thinkers are able to interpret evidence and identify the important arguments contained in this evidence. They are able to evaluate information and sources of this information, and to understand multiple perspectives and points of view.

Critical thinkers use this information to formulate inferences that are reasonable and justified. They are able to connect new information with existing knowledge and to explain assumptions and justify the results of their analyses.

In addition to being able to apply thinking skills, they are also capable of assessing the quality of their own thinking processes, and to revise their understanding in light of new evidence. Critical thinking skills necessarily underlie every stage in an effective structured problem-solving process.

A lasting benefit from your effort to practice thinking in a rigorous and systematic manner is that it will actually change your brain's capabilities. The manner in which you use your brain has an influence on your brain's physiology and therefore influences how you are likely to use your brain the future. Some recent theories suggest that just as physical exercise strengthens muscles and builds new blood vessels, mental exercise strengthens the brain's existing neurological pathways and creates new ones. Gaining practice in using critical thinking to learn skills and solve problems can help you strengthen your ability to move beyond relying on old habits and instincts, and to imaginatively and effectively address new problems as they arise.

Problem solving

The roles of a manager are many and varied, but one is common across all organizations and functions: problem solving. Research on managerial work shows that the majority of managerial time is spent solving problems. To be at work, managers must become adept at managing and using information to find and solve problems facing the organization. Managers who make the best decisions are highly valued by their organizations and are likely to receive more responsibilities and greater rewards than their less-effective counterparts.

In this course, students focus on learning a structured process for addressing the challenging business problems commonly faced by managers. As you become more adept at critical thinking and problem solving, you hone the key capabilities you will need to be an effective manager.

It has been widely argued that managers need much more than content knowledge (e.g. knowledge of accounting rules or marketing strategies). They must possess a set of skills that they can apply across a broad range of problem-solving situations. When managers possess these skills, they are equipped to effectively handle the small and large challenges that are continual features of the corporate landscape. During the term, you will have many opportunities to practice and develop important managerial skills. You will use critical thinking to learn and apply systematic problem-solving approach. And you will gain

experience in constructing workable solutions in problem situations characterized by conflicting values, objectives, and standards. Although at times these messy problems can leave you frustrated and overwhelmed, they will help prepare you for the demands of your future job responsibilities and will provide you with tools and techniques that you will find useful in tackling the problems that face you in the SBA, in the workplace, and beyond.

How to use this handbook

The PSU SBA problem-solving framework

The PSU SBA framework is the centerpiece of the handbook. The framework provides a comprehensive and systematic approach for solving complex business problems.

Although the steps are presented sequentially in an order in which they are likely to occur, the decision process is never linear. It is customary to loop back to previous stages time and again as additional information clarifies the problem, its context, and the consequences of potential solutions.

Although the ordering of steps in the process can vary, the framework is intended to be used as a whole. A process that overlooks or pays inadequate attention to segments of the framework is likely to result in a solution that, in the long run, is suboptimal.

Chapters

The chapters in the handbook follow along directly with the framework, and there is one chapter for each major stage in the problem-solving process. The text material is brief and concise. It is intended to be an introduction to problem solving, to be molded to the needs of the decision maker, rather than a set of hard-and-fast rules.

While reading the chapters, it is helpful to apply the concepts to problems through thought experiments or real-world practice. To make significant gains in the quality of your problem-solving, you will have to engage in intellectual work that is challenging and reflective. Using the information in the chapters as a foundation for developing skills will amplify those gains.

In-class activities

While problem-solving can sometimes be a solitary process, *learning* about problem solving is not. Learning is a social activity that is enhanced by discussion and critique. Activities will be provided in class for use at the end of each chapter, and are designed to be completed by a group of learners working together. Each activity is intended to be completed in a short period of time, and the activities can generally be finished during class.

The activities are matched with the chapters, and each is designed to illuminate one component of the problem-solving process. The activities are intended to serve a number of functions. They:

- enhance knowledge of conceptual material contained with the chapters
- enable students to gain skills by applying conceptual material to realistic scenarios
- strengthen and expand understanding through collaborative learning
- reinforce critical-skills and help develop a ‘big-picture’ perspective

To get the most out of these activities, it is important to reflect upon and practice the skills highlighted in the activity. This depth of thought and repetition of use helps ensure the concepts and skills are internalized and available to the manager when a problem arises.

The problem-solving framework presented in these chapters provides a concise yet thorough method for addressing business problems. The experience you gain through the activities helps make this framework your own. Taken together, the elements in this handbook provide you with tools of mind you need to master the problems you face today as well as those you'll encounter in the future.

1 - Position

Explore the problem-solving context:

- mission, vision, values
- stakeholders
- decision-making models
- impediments

Many attempts at problem solving fall short because managers don't consider big-picture contextual factors before they jump in and attempt to solve each problem as it arises. They are also often unaware of their own decision-making models and the impediments that prevent them from prioritizing their efforts and from following a systematic and rational problem-solving process. The first step in the PSU SBA system requires managers to develop an understanding of the organization's goals and constituents which provide the critical context that surrounds all problem-solving activity. Understanding this context helps lay the groundwork needed to select which problems are worthy of managerial attention and processes should be followed to address them.

Mission, vision values

Problems often arise quickly and bring with them a sense of urgency. Managers facing these problems can easily make the mistake of directing energy toward these problems without considering their real importance to the organization. Although using this fire-fighting approach to address urgent problems can have short term benefits, it diverts attention and resources away from more important long-term goals. Therefore, managers need a way to decide whether a problem is worthy of managerial effort before they think about how to solve it.

Mission

The first step in understanding the organizational context is to understand the organization's mission, vision and values. Together, they provide direction for organizational activities and provide a framework for setting priorities. The organizational mission is a description of what products or services the company offers and what customers it serves. It sets the boundaries for the organization's purpose for existing.

Vision

The vision is a description of where the company seeks to be in the future. It helps guide organizational decisions and actions toward building something beyond the current organizational reality. It provides organizational members with a shared ideal and set of goals that they can use as a compass for setting plans and evaluating progress.

Values

Organizational values reflect the organization's beliefs and ideology relating to how the company does business. The organization's values are often a function of the values of the founder or early corporate leaders. Values can't be mandated, but emerge over time and are reflected in the choices made throughout the organization's history. Values can differ greatly across companies. Companies may value competition and winning, creativity and innovation, efficiency and productivity, or technical excellence, to name just a few. Values can be very powerful, because to the extent that they are shared, they help form the basis for an organizational identity with which organizational members can identify and take

pride.

The mission, vision, and values provide a core understanding about the organization that is shared among its members and that can be used for making decisions and taking action on behalf of the organization. With this shared understanding, managers engaged problem-solving process can better pursue a course of action that is consistent with the mission and values and that moves the organization along toward the achievement of its vision. Without this ideological context, managers can direct resources and efforts in a manner that is fragmented and suboptimal for the organization as a whole.

Stakeholders

The term stakeholder is used for groups or individuals who hold a stake in the decisions taken by the organization - those parties who are potentially affected by organizational actions, now or in the future, or who can exert influence on the organization. At one time, organizations functioned mainly on behalf of the owners, or shareholders, and often disregarded other stakeholders unless and until they posed a current problem for the organization or possessed control over organizational resources.

Organizations now recognize that many stakeholder groups wield power. In addition, organizations recognize that stakeholders can be an important source of knowledge and collaborative action, and that the organization can benefit by maintaining effective relationships with its constituents. Finally, corporations granted the right to operate within a society are bound by the social contract to act in a responsible manner. Increasingly, corporations recognize that stakeholder relationships are a source of strategic capital, and make efforts to positively manage their relationships with these groups.

PEST – Political, Economic, Social, Technological

A corporation's owners, the stockholders, are often considered its primary stakeholders, but many other groups have an important stake in the organization's problem-solving activities. Stakeholders are sometimes categorized as political, economic, social, or technological stakeholders. Political stakeholders include governmental agencies and community groups that govern and monitor corporate activities. These include national and local governments along with the general public and civic groups. Increasingly, community groups include non-governmental organizations with concern about the corporation's environmental impact. Economic stakeholders include customers and suppliers with which the company does or can trade, and competitors whose actions can have an economic impact on the firm. Social stakeholders refers generally to employees and potential employees as well as unions and other groups who are interested in fair labor practices. Technological stakeholders include the firm's owners and board of directors along with institutional investors and market participants who are interested in the technical performance of the firm.

Sustainability

An organization's relationship with its stakeholders is ongoing, and over time, a history of interactions influences the character and effectiveness of the relationships. These relationships must be managed effectively if an organization is to remain viable. To solve problems in a manner that balances the interests of the owners with all other legitimate stakeholders, the company must understand the stakeholders' objectives and values. This helps enable the company to recognize potential constraints on its decisions as well as sources of opportunity. The organization can begin this process by identifying key constituencies and conduct research in order to: profile their objectives and values, develop a history of past interactions with the organization, and anticipate how the stakeholder is likely to influence the organization's choices and effectiveness.

This base understanding can be brought to bear on any specific problem faced by the organization and will provide a foundation for anticipating how stakeholders might contribute to solving a particular problem and how they might react to its solution. It can also be used as a means to determine the scope and nature of stakeholder participation in a variety of organizational problem-solving activities.

Decision-making Models

Decision making is at the core of effective problem solving. Models of decision-making generally incorporate three core activities: gathering information, generating alternatives, and selecting the best alternative. Many different models are used to describe and guide decision making, and each has advantages and disadvantages.

Rational model

The rational model, which serves as an ideal in western management, has economic rationality at its roots. In this model, the problem and goals to be obtained are well defined, the decision maker has complete information, evaluates each alternative in a consistent manner, and selects the alternative that maximizes utility. This model is thought to be the best because it is logical and unbiased. Although it is not attainable in practice, it can serve as a theoretical ideal against which to evaluate real decision-making processes.

Political model

The political model of decision-making recognizes that decision makers have their own personal agendas that may differ from organizational objectives and from the agendas of other decision makers participating in the decision or affected by its outcome. This approach recognizes that information is often incomplete, and decision-maker's biases influence their information gathering and analysis, and the choices they make. This model has the advantage of recognizing sources of conflict in decision-making, and the importance of negotiation and communication in determining solutions.

Garbage can model

The garbage can model, as the name implies, recognizes that decision making can be a disorganized and messy process. In this model, decision making does not follow a rational sequence of steps. Instead, organizations receive unpredictable flows of problems in need of solutions, solutions in search of problems, and decision makers under time and other constraints with their own personal agendas. Thus, the time of arrival of a problem, the solutions already available to the decision maker, and the demand load on the decision maker influence the manner in which the decisions are addressed.

Institutional forces also have an influence on these processes, as organizations seek legitimacy by imitating the actions of their competitors. The result is that sometimes, decisions are made through reasoned processes, and at other times, they are made by convenience or default. The garbage can model has been demonstrated to be most consistent with real decision-making activities in some complex, ambiguous organizational environments.

The PSU SBA approach developed herein appreciates the value of rational decision-making but recognizes that stakeholders have varied goals and beliefs that influence their perceptions of what is real and what is rational. We follow a process that involves corporate stakeholders. It capitalizes on political differences and alternative perspectives to address institutional and organizational forces influencing the decision making process. At the same time, it is logical, thorough, and rigorous and provides for a comprehensive and reasoned approach to problem solving.

Impediments

As discussed above, managers spend a great deal of their organizational lives solving problems. Time and effort exerted, however, does not necessarily translate into effectiveness. As noted above, problem-solving processes in real organizations more closely resemble the garbage can approach than any thoughtful, systematic approach.

To compound the problem of organizational irrationality, managers, like all humans, possess cognitive routines that are inconsistent and illogical. In part, this is a consequence of typical organizational experience. Managers develop expertise as they become aware of repeating patterns in their organizational experiences. Awareness of patterns allows managers to develop heuristics or rules of thumb that help them assess and address situations. While heuristics are helpful in rapidly and effectively sorting through the massive amount of information confronting managers throughout their daily routines, they can also be problematic in the face of complex and novel situations. 'Gut feel' or intuition in these cases may be wrong, due to commonplace problems in reasoning caused by flaws in our thinking.

The field of cognitive psychology, led by pioneers Daniel Kahneman and Amos Tversky, has uncovered a large number of cognitive biases that are widely shared by decision-makers, but that cause us to make inaccurate and irrational decisions. Three biases that affect organizational problem solving are framing biases, probability biases, and the overconfidence bias.

Framing bias

Framing bias relates to the manner in which we construct mental frameworks to deal with the complex stimuli surrounding us. We use frameworks to organize and make sense of information, and we could not function without them. However, there are some common problems with the manner in which we apply these frameworks. Among the most well-known framing biases is the anchoring bias. When confronted with a problem, we make an initial assessment and adjust from that assessment as we gather more information. This initial assessment tends to weigh too strongly on our conclusions about the situation.

For example, at the beginning of the war with Iraq, many believed that there were massive stockpiles of weapons held in that country. Despite the great deal of evidence since gathered, individuals have difficulty moving far from their original beliefs. The reasons for this are many, but one reason is that once we have made a judgment, we are likely to attend to and accept information that confirms our judgment and ignore or discount information that does not.

One way to help overcome this bias is to try to avoid jumping too quickly to a conclusion, and to question, early on, our assumptions about a problem. Attempting to restate or reframe the problem when it first confronts us can help open our minds to a broader range of information inputs. Exploring the context within which the problem arises and why it is perceived as a problem in the first place can help us better see multiple facets of the situation.

Probability bias

Probability bias detracts from our ability to make accurate estimates of the probability of an event or outcome. Probability rules are often counterintuitive, and even after formal training in the rules of probability, we are likely to make errors. If we have all the necessary data and use the right formulas, we can compute probabilities. Generally, though, we lack some necessary information and rely on our intuition and experience. When we do, we can easily over- or underestimate the likelihood of an event. For example, if a series of two coin tosses has resulted in two heads, we may have an intuitive belief that the next toss is more likely to result in tails, despite our rational understanding that the odds are 50-50.

Gathering sufficient information and taking the time to apply statistical models to our decisions can help us overcome this bias. Especially for the most consequential decisions, we can make a greater effort to seek out information helpful and to be sure that we have properly formulated and addressed key issues. Even for smaller problems, we can try to be more aware that we are making probability estimates and consider the appropriateness of our approaches.

Overconfidence bias

Overconfidence bias in our frames, probability estimates, and other judgments can cause us to act and think in ways that are not conducive to effective problem solving. Overconfidence allows us to feel confident about answers or decisions even when they are wrong. This bias is widespread and pervades our decisions and actions.

We may fail to think things through carefully or gather sufficient evidence because we are overly confident that our judgment is correct. For example, when asked to evaluate the relative risks, we may state with confidence that air travel is more dangerous than car travel and feel little need to validate this assessment. Although, mile for mile, car travel is safer, the salience and reporting surrounding plane crashes causes us to believe otherwise. Although this in itself is problematic (and it is called availability bias) it is our confidence that our judgments are correct that can cause bigger problems. Overconfidence allows us to make quick judgments and to accept these judgments without verification.

To overcome this bias, it is useful to carefully evaluate our judgments and their foundations. When a decision is important, we need to make sure that it rests on sufficient information and careful logic. It is also important to be mindful of this bias when dealing with information provided and judgments made by co-workers and trading partners who, themselves, are victims of this bias.

Ultimately, using a thorough and systematic approach to addressing problems that face us can help us compensate for the many biases inherent in our cognitive processes that lead us to inappropriate solutions. The remaining steps in the PSU SBA problem-solving framework are designed to help ensure that we accurately identify problems and that we address them effectively.

2 - Sense

Find and prioritize problems:

- problem identification
- problem finding
- structural constraints
- prioritization

One of the most common breakdowns in problem solving is failure to accurately identify the problem. When symptoms present themselves—a machine malfunctions, an order fails to ship on time—there is a tendency to make quick assumptions about the causes—e.g. improper maintenance, insufficient inventory—causing the manager to form opinions about the nature of the problem. If the problem is misdiagnosed, even the best decision-making approach can fail to identify an effective solution. As we have seen, using patterns from the past to evaluate the present can speed up and simplify decision-making, but, at the same time, can lead the company down an ineffective path of action.

In addition to incorrectly diagnosing the problem, managers are often guilty of directing attention toward solving the wrong problems. With the frenetic pace of business today, managers can easily fall in to the mode of ‘fighting fires.’ As a problem presents itself, the manager rushes to implement a workable solution, then rushes off to deal with the next crisis that emerges.

Pursuing an ad hoc strategy can avert or mitigate crises, but may do little to promote the organization’s long term objectives. Managers working in this way don’t have time to step back and consider the goals of the organization and how they might best prioritize the problems that arise. Even worse, these managers tend to deal only with existing problems, and may fail to anticipate more important problems that may lie ahead. They may also overlook opportunities and fail to direct attention toward them.

A systematic approach to sensing and exploring sources of existing problems can help managers better define the problems facing their organizations. And regularly investigating changes in the organization’s environment can uncover potential problems to be addressed in the future. Once a full range of potential problems has been identified, problems worthy of action can be prioritized and addressed.

Problem Identification

Problems are generally recognized in organizations when something unexpected happens. Problems can be viewed as normal problems to be solved in the normal course of business, or organizational crises, which are urgent and demand immediate attention.

Normal problems

Normal problems arise frequently in the course of doing business. Companies commonly maintain a full set of expectations relating to organizational activities and their outcomes. Standards and budgets comprise one formal component of these expectations, but managers hold unwritten expectations about a broad variety of states and events. When these expectations are not met—especially when the difference between expectations and experience are perceived as unfavorable to the organization—the manager recognizes the situation as a problem to be addressed.

Urgent problems

Urgent problems, or crises, are problems that present themselves to the manager in a rapid or serious manner. Crises can be caused by a variety of internal and external factors. They fall outside of the organizational patterns with which managers are familiar, so can be especially challenging to address. So-called 'normal crises' are large, unanticipated problems that arise in the course of normal organizational activities. These include serious events such as major equipment or information systems malfunctions and the loss of key customers, suppliers or personnel. These crises are unintended and unexpected.

Crises can also be caused by intentional actions. Intentional crises include such events as major computer viruses, sabotage of facilities, and accounting fraud. Finally, natural disasters, such as floods, hurricanes, and fires can create organizational crises. In general, crises are easy to identify. They have highly-visible impacts on the organization and demand rapid action on the part of management.

Change

When such problems arise, managers attempt to identify or infer the causes of the problem so that control can be restored. One of the most fruitful approaches to finding causes is through an investigation of what changed.

When a process or activity was once in control, with outcomes falling in line with expectations, and suddenly these expectations are no longer met, the likely cause lies in a factor that has changed. The first course of action is to attempt to isolate the factors contributing to the outcome and attempt to identify which of them has changed and how. If one or more factors have changed, the relationship between the changed factors and the outcomes can be investigated to determine where the source of the problem lies.

If no obvious operational cause can be identified in this manner, a next step is to explore environmental factors. Many forces external to an area of interest can have important influences on what happens within it. Changes in these forces can occur rapidly and without notice, so an investigation of which forces are relevant and how they have changed may reveal the source of the problem.

Finally, the expectations themselves may have changed. Situations once considered normal or in control may, for a variety of reasons, come to be viewed as problematic. This is often a function of changes in the experience and knowledge of parties contributing to or affected by the problem. Changes in understanding and expectations can be the result of becoming aware of opportunities and threats that arise from beyond the organization's common areas of concern. This can happen by accident or through an intentional problem-finding process, as discussed in the following section.

When problems are identified, managers tend to rely on habitual decision-making approaches. They have patterns for determining the nature of the problem, and often a set of predetermined alternative solutions that can be applied. Although these problem-solving processes are generally far less systematic and logical than the rational decision-making ideal, they nonetheless allow the organization to continue functioning on its course.

In the case of crises, organizations are generally far less prepared for the change, and are ill-equipped to rapidly develop and deploy workable solutions. For that reason, organizations can benefit by developing disaster recovery plans. Disaster recovery plans provide instructions to managers regarding how to address various crises in the event that they arise. These plans are developed during periods of relative calm, when managers can think clearly about alternatives and prepare plans for implementation.

Experience has shown that organizations with disaster recovery plans fare better in the face of critical

situations. Therefore, rather than dealing with problems only after they arise, organizations can benefit from regular exercises in which they explore potential crises and their consequences.

Problem Finding

Problem finding is the process of finding both problems and opportunities before they present themselves. Many aspects in an organization's environment influence what happens within the organization and how effective its actions can be. Environmental factors change rapidly and can cause problems or crises for organizations that fail to anticipate these changes. Alternatively, changes may present valuable opportunities to organizations that anticipate and plan for these changes. Thus, both threats and opportunities can be the subject for problem-solving activities in an organization.

Stakeholder interaction

Among the external factors that can most influence organizational activities are the organizational stakeholders. Stakeholders most directly connected to the organization can exert force on the organization. For example, a competitor can go out of business or a union can strike. Once these changes are recognized or anticipated, the organization can develop a plan for whether and how to respond to these changes. When these changes are anticipated, the organization has more time to reorganize resources and actions to effectively address the change.

All stakeholder groups can have an effect on how organizational actions translate into outcomes. Stakeholders can be an important source of information about alternatives and potential consequences. Organizational members can directly ask the stakeholders about major plans, or they can obtain information from organizational publications, analyst reports, trade publications, and a variety of other sources. By staying abreast of stakeholder plans, organizations can respond to those plans more effectively.

Environmental scanning

On a larger scale, the actions of stakeholders and other groups in the organization's environment can result in significant macro-environmental forces. Among the major forces affecting businesses are political, economic, social and technological forces. Examples of such factors include changes in regulations, interest rates, local demographics or software. The acronym PEST is sometimes used for these forces, and they are generally considered as sources of trouble. As such, they may be addressed in a formal manner only when problems or crises emerge. However, these forces can also be viewed as sources of significant opportunity and should be reviewed on an ongoing basis.

Changes in any of the macro-environmental factors can place new constraints on organizational action or they can enable the organization to pursue new markets or make improvements in products or processes. Regardless of the outcome, organizations that regularly investigate these forces are more likely to anticipate and problematize the changes, putting them in a better position to respond positively to opportunities or mitigate threats.

Scenario planning

In addition to regular, systematic environmental scanning, companies can anticipate environmental changes and formulate responses through a process known as scenario planning. Scenario planning is a tool for thinking about the organization's future. Scenarios are descriptions of potential future events and states. Anticipating the future helps inform decision making in the present.

Participants in scenario planning, often working together as a group, envision and articulate varied and

diverse visions of what the organization's future might hold. The primary function of this exercise is to help the organization predict and plan for a variety of possibilities. The scenarios generated help identify potential risks to be avoided and opportunities to be pursued. Once future scenarios are articulated and their likelihood assessed, organizational actions in the present can be adjusted accordingly.

Scenario planning provides further benefits because it can help uncover assumptions that might otherwise remain hidden and impede effective problem solving. Scenarios are a function of the organizational and environmental assumptions used to generate them. When scenarios conflict, this provides an opportunity to explore and question underlying assumptions. Differing assumptions among manager or stakeholder groups can be informative and can help the organization identify spots or sources of future conflict.

Structural Constraints

Both the problems that are *recognized* through problem identification and those that are *found* through problem finding are subject to structural forces deeply embedded within the organization. These structures concurrently *enable and constrain* the actions of managers and stakeholders of those organizations. Almost all standard western approaches to problem solving presume an individual or organization acting with autonomy to address a known problem. These approaches are highly limited because they fail to recognize the structural forces that cause problems to arise and that constrain the options available to solve them. Recognizing the basic structures that exist in firms and societies can help managers understand and contextualize problems.

Anthony Giddens' *structuration theory* provides one way to understand these structures. The theory suggests that structures are created and sustained through the ongoing actions of individuals. At the same time, the structures act upon the individuals, and enable or constrain their actions. Structures consist of rules and resources. Rules relate to norms or standards of behavior (known as legitimation structures) and communication (signification structures). These rules may take the form of formal reward systems and policies, or they may take the form of informal, tacit ways of behaving and speaking.

Resources (domination structures) include both material resources and authority, or power. These too may be formally dictated by the organization or may have a tacit existence.

While each structure alone is an important component of the problem-solving context, interactions among the structures can be influential in generating problems and constraining the alternatives available for solving them. And because structures are interrelated, change in one structure necessitates corresponding changes in the others.

For example, when an organization makes a change in policy, it must also consider how this change will influence resources and authority, and how compliance with the policy fits with current norms of behavior. A company making the decision to seek ISO 14000 environmental certification, for example, must make reallocate resources and decision-making authority and communicate the relevance and importance of the decision if it expects corporate representatives to adopt environmentally friendly processes and behaviors.

Without compatible changes across structures, operational and ethical problems can arise. When policy directives are inconsistent with authority or reward systems, problems will arise as organizational agents find it impossible to conduct their work in a manner that is compatible with all of the structural forces that enable and constrain their actions.

Problems identified in the problem-solving process must therefore be considered within the context of

these structures. Isolating and solving a problem that engenders change in one structure will have repercussions in other areas that may be or may not be desirable. Thus, a full understanding of the rules and resources affecting and affected by the problem to be addressed should be sought before managers move forward in the problem-solving process.

Prioritization

Once an organization broadens its focus beyond current, urgent problems, it needs an infrastructure for identifying and prioritizing problems. This infrastructure should include a problem-solving committee charged and a set of processes governing their actions.

Steering committee

The problem solving team or steering committee should serve as the central body for identifying problems throughout the organization. Organizational units facing significant problems should present these problems to the committee. In addition, the team should conduct regular environmental scanning and scenario planning activities to help identify problems and opportunities that are likely to be significant in the future.

Ideally, the team will consist of managers from various functional areas within the organization, along with representatives from key stakeholder groups. Diversity among participants is critical because members with differing backgrounds, expertise and goals will hold differing assumptions, values, and ideologies. A wide variety of perspectives will increase the knowledge base and will likely result in the identification of a broader range of problems than would otherwise be apparent to a group of organizational insiders. In addition, a diverse team is better equipped to understand both the structural forces and stakeholder interests that will influence how the problem is understood and solved.

Problem portfolio

The organization and its problem-finding committee must have processes in place for regular analysis of problems. Periodically during the normal course of business, and additionally when crises arise, a portfolio of problems to be addressed should be created and evaluated. For the organization as a whole, this will be done by the problem-finding team. In addition, each business unit or department should have its own procedures for identifying problems at that level.

In all businesses, resource constraints ensure that only a fraction of the problems identified can be addressed. Therefore, it is necessary to prioritize the problems and determine which ones are most worthy of organizational resources. The team responsible for prioritization must be familiar with the organization's mission, vision and values. They must also be cognizant of the needs and interests of key stakeholder groups. And they must recognize the constraints on their actions.

Ultimately, problems that are ranked as highest priority should be those that best protect or promote the organization's mission while recognizing relevant stakeholder interests and constraints. Some problems will be identified as mission-critical. These problems must be solved if the organization is to accomplish its mission. Some problems will be identified as "urgent", because action on these problems must be taken immediately. These problems should be solved only if the resources required are compatible with the degree to which they are also mission-critical. Urgent but non-critical problems can be addressed as resources permit.

Once the high-impact problems have been identified, it is useful to prepare preliminary time frames and resource allocation plans, including human resources, for each problem to be addressed. This formalizes

the problem-solving process and helps ensure that appropriate attention will be paid to those problems deemed most important to the organization.

When an organization systematically finds and prioritizes problems, a broad range of potential benefits results. Attention and resources are directed toward those problems that have the greatest contribution to achievement of the organization's long-term goals. Problem-solving efforts are less likely to be fragmented and contradictory. Stakeholder interests can be better balanced with those of the organization. And managerial attention may be directed toward the most important problems and away from those that appear to be urgent but are not mission-critical. When problem-solving efforts are directed toward a unified set of objectives, synergistic effects can result, and the combined efforts produce work and solutions that are complementary and help the organization achieve its goals.

3 - Uncover

Research causes and alternative solutions:

- causes
- alternatives
- information gathering
- information evaluation

Once the problem is defined and selected for action, it is tempting to rush in to identify a solution. In fact, managers often have a solution in mind even as they identify the problem. However, it is important to obtain a complete understanding of the problem and to explore its causes as thoroughly as possible before attempting to solve it. This reduces the chance that potential solutions aren't prematurely ruled out.

When mission-critical and other important problems have been selected the research process begins. Problem solvers pursue activities that can help to better understand the contours of the problem and identify a full range of potential alternative solutions. Key to identifying causes and solutions is gathering a broad range of supporting information and evidence, and evaluating this information to determine its reliability and relevance.

Causes

A variety of techniques are available for use in the earliest stages of the problem-solving process. Mental maps, fish-bone diagrams and causal loop diagrams are among the many graphical tools available for visualizing and understanding a problem.

Mental map

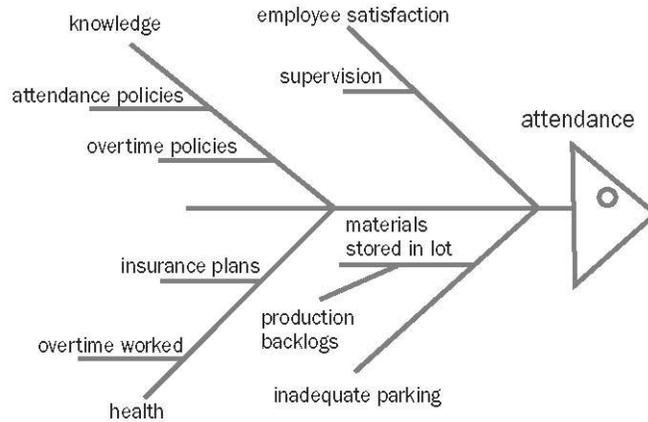
In a mental map or mind map, a statement of a problem is written in the center of a sheet of paper. Next, various aspects of the problem are identified and written on the paper. Lines are drawn between the items that seem to be most important and the central problem. Additional lines are drawn between sub-factors and important factors.

For example, imagine that a company faces a situation in which production processes are delayed because employees are arriving late and missing work. The organization refers to the problem as the 'attendance problem'. At the center of the page, attendance is written. Related factors such as attendance policies, on-time production, adequate parking and transportation, raw materials storage, employee satisfaction, and employee workload might be among the factors identified.

Fishbone diagram

Once key factors and sub-factors are identified, the mind map can be re-organized into a fishbone diagram as shown below. In the fishbone diagram, the problem is written at the head of the fish, and key factors are drawn as spines leading from the backbone. Smaller factors lead out from the spines.

This fishbone diagram shows that one factor that may be causing attendance and lateness issues is inadequate parking. Inadequate parking may be the result of storing excess raw materials in the parking lot which, in turn, may be caused by delays in production. Drawing the diagram in this manner can help identify potential primary causes of the problem and factors leading to these causes.



As the diagram is drawn, additional causes and factors relating to them are identified and organized such that the major causes for attendance are listed on the spines coming from the backbone and subordinate causes are drawn coming from the spines.

In both mental maps and fishbone diagrams, it is useful to list as many items as possible to expand understanding of the problem. This provides more information for use in alternative generation and problem research.

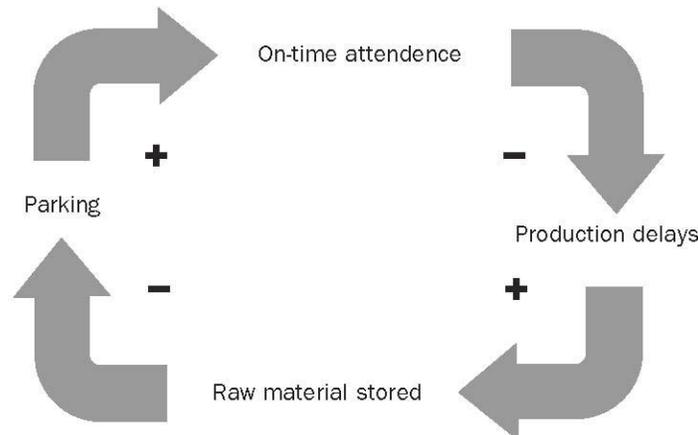
Causal loops

Causal loop diagrams represent another approach for identifying the cause of a problem. They are useful tools for exploring how factors are interrelated. A simple causal loop is shown below. In this diagram, the relationship between parking and attendance is explored. Here, attendance is shown to influence production delays. The relationship is an inverse one, indicated by a minus sign. Inverse means that the variables move in opposite directions. When on-time attendance increases, production delays decrease.

The first item has an inverse or negative relationship with the second, because when attendance goes up, production delays will be reduced. Production delays are linked by an arrow to raw materials storage. Production delays influence the amount of raw materials stored in the parking lot. So, an increase in delays results in an increase in storage. An increase in raw materials stored in parking will lead to a decrease in adequate parking as the raw materials take up space that could otherwise be used for parking. As raw materials storage goes up, parking availability goes down; the relationship is inverse. The first, and also the last, element in the loop is employee attendance. As parking improves, on-time attendance goes up.

Because this loop has an even number of minus signs, it is a reinforcing loop. That means that the situation can either get better and better, or worse, and worse, and does not contain internal mechanisms to balance the process. For example, if attendance goes down temporarily for any reason, there will be more production delays, leading to more raw material buildup, and fewer parking spaces. The reduction in parking will cause even more attendance problems and the downward spiral continues.

When a loop has an odd number of minus signs it is a balancing loop. Consider for example the relationship between hunger and eating. When hunger goes up, eating also increases, and there is a positive relationship shown by a plus sign between the two. When eating goes up, it causes hunger to decrease, so there is an inverse relationship, which will be shown by a minus sign. This loop has an odd number of minus signs, and can balance itself.



Alternatives

When the nature and characteristics of the problem are sufficiently well understood, the problem solving team can begin to generate alternative solutions. This section describes brainstorming, a technique that can be useful in developing a broad set of potential alternatives. Once alternatives are identified, the team can move on to the data gathering stage. If understanding of the problem is insufficient to lead to alternative solutions, it is necessary to work on data gathering before the alternatives are generated. In either case, it is common to move back and forth through the problem refinement, research, and solution stages until a clear understanding of the problem emerges.

One of the factors most commonly cited when an organization fails to effectively solve a problem is that insufficient alternatives were generated. The organization chose the solution from a small set of options and failed to recognize other viable solutions. Brainstorming techniques are designed to generate as many alternative solutions as possible. Many studies have shown that brainstorming generates more ideas than traditional meetings. Additional studies have shown that the more alternatives available, the better the final solution.

Brainstorming

In brainstorming, a group of participants identifies and shares potential solutions to a problem. The participants are encouraged to identify as many solutions as possible, even if they seem to be wild or infeasible. The 'crazy' solutions can serve to generate additional ideas or, upon further reflection, they may appear more reasonable. As participants generate solutions, they withhold any judgments about the solutions put forth. This helps to keep the flow of ideas moving and suppresses participant's inhibitions.

Brainstorming can be performed in a group discussion or by passing around and adding to written lists of ideas. Brainstorming can also be done on-line to preserve anonymity and lessen the influence of position or status on the outcomes. Once as many alternatives as possible have been identified, they can be grouped and/or discussed individually. Some times sticky note pads are used so that written ideas can be moved around. This can aid in the process of combining related alternatives so that the process results in a concrete set of potentially-viable alternatives.

Nominal group technique

Nominal group technique is a structured form of brainstorming in which participants begin by writing ideas on paper. Each member of the group is asked, in sequence, to provide one idea until all ideas are heard. Ideas are listed in a visible location as they are presented. Finally, members vote on the best ideas, sometimes by placing a checkmark next to the top choices. The best ideas are further discussed until

some consensus is formed.

The Delphi technique is a variation of this approach. Using the Delphi method, participants, working separately, submit ideas in writing to a group leader. The leader summarizes all of the ideas and returns the summary to the participants. Participants then evaluate the ideas and, in some cases, add new ones. The process is repeated until the group begins to form a consensus around the best ideas or alternatives.

Potential flaws

Although these techniques clearly have many advantages, their use can result in flawed decision-making. The solutions that survive the brainstorming process tend to be those that are appealing or at least acceptable to the majority of group members. There is no guarantee that the solutions proposed will be those solutions that best serve the needs of the organization. Therefore, it is essential that regardless of the specific technique used, the organizational mission and objectives are specifically addressed during the process of evaluation of alternatives. This helps participants consider a long-term, big-picture view rather than focusing in too narrowly on the problem immediately at hand.

Another potential problem as groups converge around alternatives is that they tend to consider only the immediate effects of the solutions on solving the problem at hand. These techniques consider the consequences of the solution on the problem and those individuals, or groups, who are immediately affected by it, but they generally fail to consider how the proposed solutions might affect a broader range of organizational constituents and stakeholders. Therefore, throughout the process of generating and evaluating alternatives, it is important to repeatedly remind participants to consider the consequences of their solutions for all key stakeholder groups. At a minimum, when the viable alternatives are researched in the data-gathering stage, stakeholder impact should be part of the research.

Information gathering

When conducting research on a problem in an organization, there are often many varied sources of information. Information can be written down, can be carried in the minds of organizational members and stakeholders, or can be embedded in organizational processes. Often the first step when investigating the problem context and contributing factors is to explore the problem's organizational context. The most common approaches to data gathering in organizations are reviewing written documents, questioning or surveying knowledgeable individuals, and observing actual practices.

Written documents

Written documents provide rich sources of information about relating to the background and context of a problem. Relevant documents can take a variety of forms ranging from formal written policies and procedures to periodic performance reports and other reports, and can include additional items such as memos or email messages. Such documents can be a rich source of information relation to the history of actions and outcomes relating to the problem and its variables and to ideas or insights that may point to potential solutions.

Organizations often regularly maintain large databases of documents that may be relevant to the problem at hand. Documents are often the starting point for investigation of a problem, because they help establish the formal and shared knowledge relating to the problem context.

Questionnaires

Questionnaires are generally useful for gathering facts and opinions once the problem context is better understood and specific information to be gathered is well-defined. Questionnaires generally target a

large base of individuals who possess knowledge relating to the problem. In general, questionnaires must be very carefully constructed to yield the relevant information.

Question topics should be selected so that all relevant topic areas are covered while keeping the questionnaire length appropriate to the audience and their constraints. Items on a questionnaire should be very carefully worded so that the respondent can understand the question and provide an appropriate response. Questionnaires are generally tested on a small group of respondents before they are widely circulated.

Surveys

Surveys can be conducted on paper or through in-person interviews. Both are more open-ended than questionnaires and avoid placing limits on the responses. These are useful when the problem or specific information needed to solve it has not yet been clearly defined. In general, surveys or interviews contain carefully formulated open-ended questions that direct the interviewee to topics of interest, but allow for longer responses that may extend beyond the specific question posed.

Observation

Observation is another useful tool for data gathering in organizations. Much of the knowledge in organizations is not explicit or formally stored, and instead is embedded in everyday routines and processes. Through observing processes or actions relating to a problem, information gatherers often become aware of tacit or informal knowledge and perceptions that are not captured in formal policies or documents, and may even be unknown to those possessing this knowledge.

Observation often begins with an effort to understand and flowchart relevant processes or sequences of events. Observers track the flow of activity and information in the organization and can often use this to pinpoint areas in which formal and information policies are inconsistent or in which changes have occurred over time. Both can be useful sources of information about problems that arise through the normal course of business activity. Although primary data is obtained directly from the organization and its stakeholders, information gathering efforts will extend beyond the firm. A wealth of information about the industry and the political, economic, social, and technological forces affecting is available through libraries and internet sources. These sources are often stored and searchable on line.

Online searches

Online searches begin with careful definition of the subject domain. You will need to identify the primary concepts you wish to better understand. You may wish to reformulate the problem you wish to solve into a research question to be answered. When you can develop a clear and concise question or set of questions, you will have identified the concepts of interest and narrowed your search accordingly.

Once you have done this, there are three general strategies for beginning an online search. You can begin with particular sources of information, subject directories, or search using keywords. If you are quite clear on where you expect to find the information you are looking for, for example in a specific publication, set of publications, or website, you will have certain advantages.

On the web, you can search only a specific web site for the information you seek, and within a library database you can usually specify a publication or group of publications from within which to conduct your search. This can narrow your search significantly before you begin, which can save time and help you find relevant information. This approach also ensures that information you find is from sources that you know and trust. Under this strategy, however, you are less likely to find information that is relevant to your question but falls outside your normal frame for the problem. A second strategy is to begin with

subject directories or categories. Search engines and libraries generally have detailed subject directories that can help direct you to content area related to your topic of interest. This approach can help you to understand the general dimensions of your topic and to narrow it to specific fields of interest. You may also find general overviews related to your topic. Subject directories can also help you find common words relating to your subject that may be useful in conducting keyword searches.

The final strategy to use keyword searches using a search engine or database. Search engines explore and index web sites for rapid searching. They use complex and varied algorithms to determine how to respond to a user query, but in general, they find sites where the key word appears in the page title and/or the body of the page. Pages are often prioritized based on how many other sites are linked to them.

Databases generally search for key words in specific parts of the data items. For example, if your database contains journal articles, a keyword search may search titles and abstracts only. You can generally specify what parts of documents or pages you wish to search, and instructions for doing so are generally readily available.

Use of a word search strategy requires identification of key words and synonyms relating to the concepts of interest. If you have stated your problem as a question, keywords are generally the nouns, verbs, and objects of the sentence and their modifiers. When individual keywords are very common, it is helpful to identify key phrases relating to the concept. Also consider stems or variant forms of a word. For example, keywords “mechanic” and “mechanical” will lead the search in different directions.

Search engines vary in their rules regarding appropriate syntax for searches, so it is necessary to become familiar with the specific rules for the search engine or database you are using. However, they commonly rely on various forms of Boolean logic, so it is useful to know a few basics. You can generally use the term “AND” or a “+” to indicate that you wish to find only documents that contain all of your terms. By separating your keywords with “OR”, you can find documents that contain any of your key terms. To eliminate results with a particular word, you can use “NOT”. You can also use parentheses to separate parts of your argument, for example, you could enter “(women OR females) and diet and not Atkins”. If no logical operators are supplied, search mechanisms commonly infer that keywords have an “and” relationship.

Web search engines have many other useful features. Again, syntax for using these features varies so you must consult your search engine’s guidelines for specifics. Generally, when using a phrase, you can put quotations around the phrase so that only documents with the exact word sequence will be found. Sometimes, you are able to search the title fields of web pages, so you find only results in which your search term appears in the title. This helps ensure that the entire page is about your topic. To do this, you can use terms like “title: diabetes”, or for Google “intitle: diabetes”. You can sometimes narrow even further to the URL (web address) by using url: diabetes or inurl: diabetes.

Information evaluation

Each source of information has its own problems that can make it incomplete or unreliable. Before information can be relied upon for problem solving, its quality should be carefully evaluated.

Reliability

Interviews and questionnaires must be framed carefully to overcome the respondents’ desire to give the questioner the answers they appear to be seeking. Observations can create an effect whereby the observed, wishing to be seen in the best light, alter their activities during the period of observation.

Documents may be inaccurate or incomplete, and formal written policies and procedures can vary dramatically from those actually in action. Finally, information archives may not exist, or may be gathered haphazardly so that they are incomplete and contain inaccuracies that inadequately inform the situation under study.

Because of these problems, it is important to take care to use all mechanisms available, including a wide range of respondents and sources for materials, and to compare findings from one approach with that of another. To address the problem, data gathered from all of these sources must be combined and digested. Throughout the process, the completeness and accuracy of the information should be assessed, and the data gathering process should continue until the problem-solver has a good understanding of the situation.

Information obtained from web sites can be even more problematic. In general, information is only as good as its source. Anyone can post information on the web, and much of the information you find there would not meet the tests for accuracy and objectivity expected from printed sources. Therefore, one of the best ways to evaluate the validity of the information is by determining who posted and supports the maintenance of the information. You can scan a page or site to look for the author of the information, which may be directly listed.

Generally, a reputable page will have links to a home page where you can find information about the sponsor of the site and about the purpose of the site and the information provided there. If no links exist, you may be able find the home page by truncating the URL to the first /. You can also look at the URL to determine whether your source is a commercial site or a governmental, organizational or university site (.com, .gov, .org., edu). You may also be able to tell if it is a personal site by looking for personal names following characters such as “~” or “%”.

You can get a feel for the nature and purpose of a web document from the tone of the document. If it sounds like an advertisement (or contains ads) or has an informal feel, you might question the author’s purpose in posting the information. You can determine whether the information is current by using your web browser to examine the file properties. In general, older files and web sites that are not updated frequently might contain information that is out-of date or otherwise suspect.

Information stored in library databases has generally been pre-screened, so the source of the information is generally a less important issue. For this kind of information, and for other on-line information, once the validity of the source has been established, the content of the information becomes the subject of question.

Evidence

Before relying on information, it is important to think critically about what you read. The first step is to identify the issues raised or main thesis of the document and to find its conclusion. From this, you can often determine whether the purpose of the document is descriptive—to describe something, or prescriptive—to prescribe what we should think or do.

Next, you can identify the reasons or evidence presented in support of the conclusion. Once you have identified these reasons, you can question their validity to determine whether they make sense and whether they lead to the conclusion. Reasons presented in a document must have some support behind them. This can take the form of logical argument or empirical evidence, but you must be able to understand and agree with the reasons before you can rely on an author’s conclusion. Often, conclusions don’t flow directly from the reasons. Instead, the authors’ assumptions and values, which commonly go unstated, drive the conclusions. Therefore, it is important to carefully question the logic of the reasons

and their relationship to the conclusion.

Logical evidence supporting reasons can come from the author's beliefs or experience, or the author can cite experts who hold the same opinion. This support should be questioned, just as it is when the evidence is empirical. With empirical evidence, the representativeness of the sample should be evaluated, as should the validity of the statistics presented for the support.

In addition to questioning the support provided in the document, you can question whether important information has been left out or hidden from the reader and consider why this information was not included. And you can consider whether there are alternative conclusions that can be drawn from the reasons and evidence presented. Sometimes alternative sets of values and interests can combine with reasons to support a conclusion other than that presented by the author. Careful evaluation of information helps ensure that solutions rest on reliable support.

4 - Solve

Analyze and evaluate alternatives:

- descriptive analysis
- numerical presentation
- solution formulation

In solving business problems, research and data gathering often results in both qualitative and quantitative information. Once qualitative information can be assessed using the procedures for information evaluation, it can generally be understood by through individual and group interpretations and discussions. Quantitative data sets used as evidence provide far greater challenges to problem solvers, because the assumptions and objectives underlying their capture and presentation are more difficult to ascertain.

Descriptive analysis

As managers move from uncovering information to forming solutions, they often use numerical analyses as mechanisms with which to develop, evaluate, and compare potential solutions. Procedures of descriptive analysis are used to describe the contents of a numerical data set and provide a description of the underlying reality the data represent. Statistical tests can be used to answer questions and test assumptions. Such analyses can be useful in comparing alternative solutions or predicting their consequences.

Perspective

Many standard approaches to descriptive data analysis are available. Although the procedures provide the appearance of being neutral, the beliefs and values of the decision maker will influence the way the data are analyzed and how the results are interpreted. It is important to keep this in mind and to test out multiple meanings for the data and alternative explanations for the findings. This helps avoid the problem of latching on to a single solution before all viable alternatives are carefully explored. As noted earlier, a project team with diverse backgrounds and goals can help to provide a richer analysis of qualitative and quantitative data.

When using data sets, the problem solver plays a key role in determining what questions to ask of the data and in how to interpret the results. The old adage: “we find what we look for” is particularly relevant when we deal with quantitative data sets. It is therefore important as we conduct the analysis to ensure that presuppositions, expectations, and interests aren’t driving interpretations of the data. Viewing the data from multiple stakeholder perspectives is helpful in this endeavor, as is taking the role of devil’s advocate by thinking about what analyses you would conduct if you held a set of beliefs in opposition to your own.

Summaries

One of the first activities we can perform in seeking to understand the data set is to prepare summaries of the variables. For categorical variables (e.g. male or female, rating of 1, 2, or 3) we can perform counts of the relative number, or frequency, of occurrence of items in each category. We can use the counts to determine the percentage of the total represented by each category.

For continuous data, we can calculate totals, averages and estimates of variance. Totals are useful for

data relating to costs or magnitudes and can tell us something about the sample as a whole. Averages can be prepared by calculating the statistical mean, median, or mode, and provide a quick and useful way to describe the variable (e.g. the mean age of PSU students is 27). Averages can be prepared for the total data set or for individual categories (e.g. the mean age of female PSU students is 26).

Variation

Measures of variation can be used to explore dispersion of the data, and are helpful in determining how well the average represents individual items in the data set. We can look at the spread between the highest and lowest values in the sample or arrange the data from low to high and look at it by halves, quartiles, deciles, etc.

We can calculate the variance and standard deviation, which show how far away the individual data items are from the mean. For a sample of size n , the variance is:

$$Var(\bar{X}) = \frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2$$

The standard deviation is the square root of the variance:

$$\sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2}$$

Simply describing the mean and standard deviation can tell a lot about a variable. If the data follows a standard bell-shaped distribution, approximately 2/3 of the data items will fall within one standard deviation of the mean, and approximately 95% will fall within 2 standard deviations. The coefficient of variation is the standard deviation divided by the mean. It is expressed as a percentage and allows us to compare the variability of data items or samples.

Plots

When the data set contains two continuous variables, we can explore the relationships between them. For example, we could explore the relationship between student age and number of credit hours taken per term. We can plot the variables on the x and y axes of a graph to get a visual image of their relationship. If the points plotted fall into a line or other pattern, there may be a relationship between the two. When we estimate what that relationship is, we can estimate values for data not currently in our sample.

For example, if our data contains ages and course loads, we could estimate the number of credits a 25-year-old student is likely to take. A more reliable alternative to the scatterplot diagram is a regression analysis, which can be easily performed using standard spreadsheet software.

Regression

Regression analysis calculates the line that best fits the data set. In addition, it provides a coefficient of determination, generally referred to as R-square. The R-square value ranges from -1 to 1 , and provides an estimate of how closely the variables are related. An R-square of .11, for example, suggests that the variables are directly related, and that about 11% of the variation in the y values can be accounted for by changes in the x values. A significance of F value of $<.05$ suggests that it is unlikely that these results happened purely by chance.

Regression Statistics	
Multiple R	0.354179
R Square	0.1254427
Adj R Square	0.1111057
Std Error	2.1685335
Observations	63

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	41.145221	41.14522	8.749579	0.0044
Residual	61	286.85478	4.702537		
Total	62	328			

<i>Coefficients</i>		<i>Std Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	10.5187	1.3182339	7.979391	0.0000
X Variable 1	0.16793	0.0567753	2.957969	0.004401

Summary matrix

When the data set contains multiple continuous and categorical variables, tables summarizing the data by various combinations of categories can be constructed. For example, consider a data set that contains two categorical variables: East and West divisions, and Regular and Super stores, along with one continuous variable—dollar sales by store. In this case, a simple matrix such as the one shown below could be used to describe the data.

Sales by store type and region (in \$000s)

	East	West	Total
Regular	140	220	360
Super	75	90	165
Total	215	310	525

In addition to descriptive analysis of the data, data sets can be used for drawing inferences about a population. In exploring data sets, it is natural to form opinions about the data. Some of these opinions are common and easy to test. Two of the most basic and commonly-used statistical tests are test of means and the goodness of fit test.

Test of means

The test of means can be used to compare the mean value of a population to some static value or to the mean of another population. It can also be used to compare the proportion of a variable in a population with a static proportion or with the proportion in another population. The t-test can be used to answer such questions as: is the average GPA of full-time students higher than that of part-time students? Is it higher than 2.5? Is the proportion of full-time students greater than that of part time students? Is it greater than 40%? The test of means results in a t score, or z score for larger samples. This score is compared to the t or z score that has been determined to be minimum needed to reject the hypothesis based on the desired level of significance (probability of rejecting the hypothesis when it is true).

Goodness of fit

The chi-square goodness of fit test can be used to test whether the data matches up to, or fits, some

expected pattern. For example, we could use chi square to test the assumption that there are 50% female students and 50% male students. The test can also be used to test whether two variables are independent. For example, using data in the sales matrix provided above, we could test whether easterners spend more sales dollars in superstores while westerners spend more in regular stores.

As the data set becomes more complex, a broad range and variety of additional statistical tests becomes available. When solving a problem requires asking difficult questions of the data set, it is worthwhile to utilize more advanced statistical tools. These tools are readily available in many business software packages.

Presenting numerical data

Numerical information is often difficult to comprehend, and care must be taken to present the data in a manner that makes it accessible and understandable to the viewer. A few basic principles are useful in this endeavor.

Descriptors

First, it is important to use appropriate descriptors for a report and its contents, such as titles, headings, and labels. The purpose of the numerical report, along with the author and date can help place the data in its appropriate context. Data items should also be carefully labeled, so that the meaning of each item presented can be understood. Keys and legends can be used as necessary for identification.

Formatting

Formatting of the data is also important. In general, users of data can only understand and perform even simple calculations with two significant digits. Therefore, whenever possible it is helpful to round off numbers. When there is a lot of data to be presented, it can be difficult for the viewer to follow it. Fonts and other highlighting effects can help call attention to key data or to keep rows or columns separate. Using lines between separate categories of data can also help differentiate the data. Blank space serves a similar purpose, but too much space between numbers can make it difficult to make comparisons between numbers or match up variables relating to a single data item.

Summarization

Report organization can influence the comprehensibility of the data. When a report contains numeric data that is likely to be summed, or otherwise compared mathematically, that data should be organized in columns. Viewers are likely to be faster and more accurate in their calculations when the data is presented in columns rather than rows. If there are many data items in a single report, it may be useful to organize the rows or columns so that either the most important information appears first, or a key variable is sorted from largest to smallest value.

Providing basic statistical information about the data can make their meaning more clear and improve usefulness to the viewer. Including summary totals, averages, percentages, or counts along with the data presented can save time for the viewer and assist in conducting basic analyses relating to the data.

When using spreadsheet software for data analysis, raw data should always be separated from the analytical portion of the document, and the analytical portion should contain only formulas. This improves the understandability of the report because it helps to differentiate between the data inputs and the analytical results. In addition, separating the data from the analysis helps to ensure that the output remains accurate when the values of data inputs are changed.

Solution formation

The process of gathering and exploring problem-related information naturally results in a narrowing of the set of potentially-viable solutions remaining. When too many alternatives remain, more research and analysis is necessary to better define the problem and evaluate alternatives. After qualitative and quantitative information has been thoroughly examined, a final solution or set of alternative solutions can be formulated.

The information gathered and analyses performed can be used as a basis for estimating the potential effectiveness of each of the remaining solutions. Depending upon the problem-solving circumstances and the needs of the decision-makers who will select and implement the final solution, one or more alternatives may be desirable, and a separate business case can be formulated for each.

Viability

Viable solutions must have adequate logical and empirical support. Research and analysis process must ensure that each part of the solution can be carefully considered, both on its own merits and as part of the overall solution. Before a final set of alternatives can be selected, problem-solvers must ensure that each part of the solution is thoroughly and effectively supported by the data and analyses.

In addition to meeting the test of logic, the solutions must ultimately accomplish three objectives. First, the solution proposed must adequately and effectively address the problem originally posed. As the analytical process moves forward, it is easy to lose sight of the original question driving the research in the first place. There must be a match between the problem and the solution.

Second, the proposed solution must be consistent with the organization's mission, vision, and values. Even if the original problem was selected because it was deemed to be mission critical, the solution will not necessarily serve the organizational needs. Before moving on to the business case stage, the alternative solutions remaining must be evaluated to determine whether and how they promote the objectives of the organization.

Finally, the potential impacts of each alternative on the organization and its stakeholders must be examined. The potential for one alternative solution to cause problems in other areas of the organization must be explored. The impact on the rules and resources relating to all affected organizational units should be anticipated. Impact on stakeholders in light of ongoing stakeholder relationships must also be considered, as must potential stakeholder responses to proposed solutions.

Quality

Alternatives that pass all of these tests can be evaluated based on the degree to which they accomplish the original purpose in solving the problem and on the outcomes they suggest for the organization and its stakeholders. Several alternative approaches are available for structured comparison of the relative quality of the alternatives.

To systematically evaluate the alternatives based on the degree to which they are consistent with organizational objectives, a rating system can be developed. A common approach is to identify key objectives or criteria associated with the decision to be made, and to determine their relative importance. Weights that reflect relative importance are then assigned to the criteria.

Viable alternatives are then given a rating for each objective or criteria, based on the degree to which they effectively address the objective. Individual ratings for each criterion are multiplied by criterion weights.

The results are summed for each alternative, and a weighted average score for the alternative is determined. Scores provide an indication of the degree to which each alternative is effective in addressing the relevant criteria. Alternatives are ranked and discussed using this weighting scheme.

In addition to its function in comparing alternatives, using a matrix approach can be very helpful in clarifying the criteria to be used and exploring relationships between the criteria and the organization's broader mission and objectives. It is also helpful in fleshing out important aspects of alternatives, which must be known in order to evaluate the alternative.

Finally, when used by a group of problem-solvers, differing assumptions about criteria and alternatives as well as differing opinions about the importance of those criteria and the value of alternatives can be surfaced through this process. Through the discussions resulting from these differences of opinion, better understanding of the problem-solving situation can be gained, and greater consensus among participants formed.

5 - Build

Build a business case:

- ethical screen
- cost/benefit analysis
- feasibility analysis
- argumentation

A business case is used to formally present and justify one or more solutions that were developed and deemed acceptable in the Solve stage of the problem-solving process. The business case will be reviewed by a decision-making body, who will determine whether a proposed solution has merit and is deserving of the allocation of scarce organizational resources.

To be valid and convincing, the business case must be built upon a strong foundation of solid logic and supporting evidence. Before the business case is formulated, the problem-solving team must ensure that sufficient research and analysis have been performed and that the proposed solution meets the decision criteria as well as the ethical standards of the organization and society.

During the process of developing the business case, the problem and solution options are often better clarified and understood. In some cases, it becomes apparent that further research is needed to strengthen the logic or support, or even to explore alternatives previously ruled out.

Earlier, it was suggested that the problem-solving team be made up of a diverse group of organizational members along with stakeholders in participatory or advisory roles. This team or a subset of its members should also be involved in the development of the business case. During the development of the business case, an in-depth analysis of the outcomes is conducted. Short- and long-term consequences for the organization and its stakeholders are explored and summarized as the case for the proposed alternative is presented. In addition, the team reviews once again the organizational mission and objectives and the environmental context.

The outcome of the team's efforts will be the final business case report. The report will provide a summary of the organization's history relating the problem, a description of the problem, a discussion of alternative solutions, and a clearly-articulated and well-supported case for the proposed solution.

Ethical Screen

One final assessment of a proposed solution must be conducted before the business case is initiated. This assessment is known as the ethical screen, because it is designed to screen out any potential courses of action that would be incompatible with organizational or societal values. Before the solution is finalized and moves on to be presented to those who will ultimately accept or reject it, the problem-solving team must be confident that the solution meets the certain ethical standards.

Several screening mechanisms are available for evaluating solutions. Classical Western philosophy relies on concepts of rights and consequences, and traditional philosophical approaches provide valuable guidance, especially for addressing problems that present themselves as ethical dilemmas.

Even though many problems are not perceived by decision makers as 'ethical' problems, all business problems have consequences that affect stakeholder groups—in many cases consequences that alter the

distribution of power or wealth or can affect stakeholders' livelihoods or health. Thus, every corporate action or decision is governed by ethical norms. A simple and basic ethical approach that addresses duties and consequences considers, at a minimum, two main factors: the company's values and the company's stakeholders.

Values assessment

All corporations are characterized by the values they hold deeply. Solutions for which problem solvers seek to build a case must be consistent with those values. Values can easily be overlooked as situational objectives and goals take center stage—especially in the context of an organizational crisis. But as discussed in the structural forces section, the values held by a corporation become deeply embedded in the power and reward systems of the company. Solutions that redistribute power and rewards may be inconsistent with corporate values, and may create future problems as broader structural forces are brought into conflict.

In addition, any action taken by a corporation or its agents will have the effect of either reinforcing or challenging existing structures. Problem solvers often look to their superiors and peers to determine which kinds of actions are appropriate and which aren't. So actions taken can help establish or strengthen company norms and can have effects that last much longer than the immediate problem solution suggests.

Stakeholder analysis

Values internal to the organization and held by its managers, however, cannot be the only factor considered in the ethical screen. As many recent corporate scandals have demonstrated, corporate values are not necessarily consistent with ethical values held by society or even with the law, which is often viewed as defining a minimum standard of acceptable behavior. Thus, it is useful to evaluate the proposed solution according to a broader set of ethical principles. A stakeholder analysis can be one approach for accomplishing this.

Stakeholders can be useful both in exploring relevant ethical values and in considering the potential consequences of the proposed solution. A company's customers, suppliers, and competitors can be used as peer referents to explore business practices and policies that are accepted as norms within an industry. While it is true that an entire industry can be governed by less-than-desirable ethical values, it is more likely that looking to this broader group may provide a more solid ethical baseline than that provided by an in-company insulated view.

Including political and social stakeholders broadens perspectives further still, to incorporate values accepted by the communities and societies within which the firm operates. This broadened perspective also takes into account environmental values, which may not be highly salient within a particular company.

While the stakeholders provide guidance regarding accepted standards and norms, they are also an important source of information regarding the ethical status of the potential outcomes that will result upon implementation of the proposed solution. Thus, consequences that can potentially affect each of the corporation's stakeholder groups should be examined and evaluated. For important decisions or those with the potential of heavy impact on one or more stakeholder groups, the stakeholders themselves should be given a voice in the discourse surrounding whether or not a solution is adopted.

Following a process that provides fair and open input to stakeholders results in solutions which better meet the interests of potentially affected stakeholders. In addition, it creates a system of procedural justice that renders outcomes morally defensible regardless of the specific consequences for individual

stakeholders.

Cost/benefit analysis

The core component of the business case is the cost/benefit analysis, in which the monetary and non-monetary costs and benefits of the proposed solution are presented. In building the cost/benefit analysis, the team should review the organization's mission and objectives and consider how this is impacted by the proposed solution. During the problem finding and prioritization stage, problems expected to have a support accomplishment of the mission and goals were supported. As the case is built, the project team should ensure that the proposed solutions meet the original objectives.

The team preparing the case should also consider the stakeholder groups potentially affected by the proposed solution, reconsider stakeholder values and interests, and consider how the proposed solution will affect each of the stakeholders. Responses or reactions by stakeholders to the proposal should also be anticipated, so that both the cost/benefit analysis and later, the implementation plan, can take these responses into account.

The cost/benefit analysis generally takes one of two forms. It can lay out a single proposed solution for consideration and then detail the costs and benefits of this solution relative to the course of action that will otherwise or is currently being pursued by the organization. Alternatively, if there is more than one alternative solution under consideration, the analysis can provide a side-by-side comparison of these alternatives for the organization and its constituents.

Relevant costs

When identifying the costs and benefits of an alternative, it is important to consider the true effects of the alternative from the date at which the analysis was conducted forward into the future. Only the incremental costs—costs that will change if the alternative is pursued—are relevant to the decision. Costs that will be incurred regardless of the alternative selected should be left out of the analysis, or included in the analysis of all alternatives that will incur the costs. Costs already incurred in pursuing this or some alternative course of action are considered to be sunk costs, and they are irrelevant to the decision process. The goal is to pursue the course of action that best meets the needs of the organization at this point in time, regardless of what decisions were made in the past. In addition, opportunity costs, the values of opportunities forgone if one of the alternatives is selected, are also irrelevant. If there is a significant opportunity cost, this cost should be listed as a benefit in the cost/benefit analysis of the alternative to which it relates.

Costs and benefits included in the analysis will be both the one-time costs of implementing the solution, and the ongoing costs of pursuing the proposed course of action. Because of this, the project team will need to project a time frame for the solution analysis. This can be the length of the project proposed, or some time period after which it can be assumed that the organization's course of action will be changed once again.

Intangibles

Costs and benefits included in the analysis can be quantitative or qualitative; tangible or intangible. The more thorough analysis of potential costs and benefits of the solution, the better the decision about selecting the solution can be made. In addition, these costs and benefits will be useful in formulating a plan for effectively implementing the solution.

When listing the costs and benefits, it is standard practice in a business case to list those that can be

quantified in dollar terms first. When costs are incurred or benefits realized over multiple periods, the amounts can be discounted to the present, or a multiple-year analysis can be presented. Because costs and benefits expressed in dollar terms are more tangible and readily understandable than qualitative items, it is useful to attempt to estimate the dollar impacts of costs and benefits wherever possible. When such estimates are not feasible, other numeric information, such as quantities also generally have more impact than narrative description.

For costs and benefits that cannot be quantified, descriptions are included in the analysis. Where possible, these descriptions should relate the costs and benefits to the organization's mission and objectives. These descriptions should be as clear and concise as possible, and bulleted or numbered lists are easier to evaluate and compare than detailed paragraphs. As with all parts of the business case, it is helpful to provide the minimum amount of detail needed to make a convincing case. Other supporting information can be provided in appendices or made available upon request.

For analyses with multiple alternatives and/or lengthy listings of costs and benefits, summary information can be provided. In summarizing, the most consequential costs and benefits should be highlighted and restated. Ultimately, the summative impact of each alternative solution on the organization's goals should be clearly articulated and presented.

Feasibility analysis

The feasibility analysis can be conducted as part of the cost/benefit analysis or in addition to it. Despite the relative merits of the recommended solution, there may be factors that make its adoption by the organization infeasible. Thus, for every viable alternative solution, a full feasibility analysis should be conducted.

The proposed solution must pass feasibility evaluations in a variety of dimensions, including economic, organizational, technological, and legal. The cost/benefit analysis will provide an estimate of the dollar outlays required to pursue the solution. To determine whether the solution can be feasibly pursued from an economic standpoint, the organization must evaluate its budgetary and cash flow constraints and resource commitments during the timeframe laid out in the solution. Economic resources are generally scarce, so economic feasibility is always an important concern, even for projects for which financial benefits exceed costs.

Analysis of the operational feasibility of the project is also important, as these resources are similarly scarce in organizations. Experienced personnel capable of managing and supporting the project and carrying out specified tasks must be available during the time period of the proposal. Organizational resources commitments must be evaluated to determine whether it is possible to direct resources to the project as needed.

Information technology and other technologies needed to pursue the recommendation must also be assessed. At times, project solutions are built upon technologies that are under development. Assessments must be made regarding whether the requisite technology is currently available or can be obtained or developed timeframe required for the project.

Finally, legal feasibility must be assessed. General laws governing corporate activity should be evaluated along with organizational contracts and covenants to ensure that the proposed solution fits within the legal boundaries of the organization.

Argumentation

The cost/benefit analysis that forms the core of the business case for the proposed solution must be accompanied by a clear, written argument to support the case. Argumentation is used to define the problem, define the solution, and provide strong support for the solution and its ability to effectively address the problem.

Throughout the development of the argument for the proposed solution, it is important to be clear and concise. Only information critical to the development of each aspect of the argument should be included in the business case. Additional details can be referenced and included in the supporting documentation.

In general, business decision makers are overloaded with information and operate under tight time constraints. Thus, the business case must lay out an argument that is complete and convincing, but at the same time is succinct and rapidly accessible and easily comprehended by the reader.

Context

The business case normally begins with a brief introduction that provides background for understanding the problem to be addressed. The introduction should provide clues about the severity and urgency of the problem and how the organization is negatively impacted by it. Historical information about the organizational unit and/or the problem can also be provided in the introduction along with an indication of the key factors that brought the problem in to existence. In general, the introduction should provide contextual information necessary for fully understanding the problem and solution.

Problem

The problem addressed or question pursued should be clearly stated. If the problem is complex, each major part of the problem should be developed and articulated. In addition, a case must be made for why the problem is worthy of organizational attention at the current time. Supporting information that underscores the importance of the problem to the organization and its stakeholders should be provided. Ultimately, the case must be made that the problem is significant, and pursuit of a solution is a worthwhile use of organizational resources.

Solution

Next, a description of the proposed solution or solutions should be provided. The business case should lay out a definite claim or proposal relating to the problem stated that suggests a call to action in addressing the problem. The logical link between the problem and the solution must be carefully explained in this section. Arguments relating to the nature of the solution and its ability to effectively address the problem must be developed fully, one at a time. Each argument must be clearly articulated and must be linked to the proposed solution. Each argument must be carefully supported with logical and/or empirical evidence.

Audience

In laying out the case for the proposed solution, it is useful to consider the likely audience for the business case. The case should be framed such that it speaks to the interests and needs of the recipient. To strengthen the case, it is important to anticipate potential objections the reader might make to any part of the case—the problem, the solution, or the support for the solution—and to directly address those objections or provide information that will counter or inform them. In addition, it is useful to identify any alternatives considered by rejected and to explain why.

Readers will naturally create their own alternative solutions once they understand the nature of the

problem. Helping them understand why these alternatives are inferior to those you have laid out is useful in supporting the proposed course of action.

The report ends with a conclusion that sums up what has been said about the problem, the solution, and the effectiveness of the solution in addressing the problem. This is the final opportunity to build the case, so once again, arguments relating the proposed solution to the organizational objectives and stakeholders are central to the case.

Executive summary

After the numerical analysis and supporting arguments have been fully developed, it is useful to prepare an executive summary. The executive summary precedes the full business case and is used to provide a brief but complete overview of the most important elements of the case.

The summary should explain the purpose of the business case report, present the context, define the problem, describe data gather and analysis processes, and present the proposed solution, implementation overview, and expected outcomes. The summary should be as brief as possible, while providing an overview of key elements of the full report that can stand on its own. The summary may be the only part of the report read by decision makers, and it can be used to make decisions about whether to read the full report, or can even be used as support for allocating resources or taking action.

6 - Achieve

Implement and evaluate:

- implementation plan
- outcome measures
- process evaluation

In the final stage of problem solving, plans for implementing and evaluating the solution are clarified and executed. The problem-solving team prepares detailed guidelines for implementing the solution and achieving the desired results. Included in the implementation guidelines are plans for measuring and evaluating the outcomes of the solution after the implementation has taken place.

In addition to taking responsibility for the final outcomes, the problem-solving team must be accountable for the effectiveness of the process used to achieve these outcomes. The team will evaluate the process used and make recommendations on how the process might be improved for future problem-solving endeavors

Implementation plan

The first step in ensuring that the proposed solution achieves the benefits laid out in the cost/benefit analysis is the development of a detailed plan for implementing the solution. Recall that in the earliest stages of the problem-solving process, the project team evaluated the organizational mission, vision and values and identified problems that could best support the organization's accomplishment of its mission. These original objectives guided the research and analysis of the problem and were incorporated as benefits in the cost/benefit analysis.

An effective implementation plan should help ensure that the costs of the project are managed in line with expectations and that proposed benefits are achieved. At the implementation stage, the project team will normally be reconstituted to include greater representation from the organizational units and stakeholders most directly involved in and affected by the project.

Change management

Implementing a solution often means significant change for the organization and its stakeholders. Effective management of change requires problem solvers to address the barriers that typically impede change. Among the most important of these barriers is resistance to the change by those individuals most likely to be affected by the change. To mitigate resistance, it is critical to involve the affected groups in the implementation process. When the affected individuals have involvement and influence in decisions about changes that affect them, they are more likely to accept the results of those decisions. Thus, the solution is more likely to be successfully implemented.

More importantly, the individuals affected by the implementation can contribute valuable knowledge to improve the effectiveness of the solution. Those who will play a role in or be affected by implementation of the solution are best able to understand how it will affect business processes in affected units and how proposed changes will interact with important features of the organizational environment. Thus, involving affected individuals will lead to an implementation plan that is consistent with the structure forces affecting the organization and its stakeholders, and as a result, more likely to be effective in realizing the benefits of the problem solution.

Project management

Another approach to managing the implementation and associated changes involves the use of project management techniques. When the implementation process is well planned and monitored, its effects on individuals are more predictable and dependable. This can make the change less disruptive to the work lives of affected individuals. A variety of project management techniques are available for managing the implementation process.

Among the most well-known project management techniques are critical path, PERT, and GANTT approaches. All of these techniques share common core elements: the project is broken down to a set of activities, a time schedule for completion of the activities is prepared, and human and financial resources are allocated to the activities.

Activities

The first step in preparing the implementation plan is to develop a detailed list of activities to be conducted. Activities should be clearly defined and, depending upon the complexity of the project, the activities are further broken down into sub-activities. Ultimately, if each of the activities are performed as planned, the solution will have been effectively implemented. Thus, all activities necessary to implement the solution must be included, and the problem-solving team must clearly define each activity and identify means to identify when the activity has successfully been completed.

Time schedule

After all activities have been identified, a time schedule will be prepared. The schedule generally estimates the length of time needed to perform each activity and determines starting and completion dates for the activities. In some cases, it is difficult to predict exactly how long an activity will take to complete, so a range of completion times is estimated. As the project progresses, the time schedule is useful for motivating participants to complete the activities on schedule, for identifying problem areas in which an activity has fallen behind schedule and for estimating the final completion time for the full solution.

Resources

In addition to determining the time required for each activity, the problem-solving team will identify the resources to be allocated to each of the activities. In the cost/benefit analysis, estimates were made for the human and financial costs of the entire project. In the implementation stage, these costs are allocated more finely to the individual activities. An individual or organizational unit will be assigned to complete each of the activities, and one person will be responsible for managing completion of the activity. Estimates of the labor costs necessary for completing the activity will then be made, as will estimates of the material and other related costs. Resources will then be allocated to each of the activities, and plan for release of these resources will be prepared (for example, resources can be released all at the start of the activity or smoothly throughout).

A large variety of project management software is available for planning and tracking projects. This software is especially useful in large, complex projects with many activities or in projects in which activities are interdependent and some are completed simultaneously.

Outcome measures

Once the solution to a problem has been accepted and implemented, it is commonly forgotten as members of the organization refocus their efforts toward other pressing problems. It is important, however, to make the effort to determine whether the solution was a success and why.

If it was not successful, further effort may still be needed to effectively address the original problem. If the solution is a success, the organization can transfer lessons learned from this problem to similar problems that arise in the future. To ensure that the outcomes from the solution are addressed, the final activity in the implementation plan can be an activity that involves measuring the project's key outcomes.

Benefits

The cost/benefit analysis prepared in the Build stage of the problem-solving process identified specific benefits expected to arise through adoption of the proposed solution. During the Achieve stage, the problem-solving team identifies ways to determine whether the proposed benefits have, in fact, been realized.

To do this, the team will develop a set of outcome measures and a plan for taking and interpreting the measurements. Benefits identified in the cost/benefit analysis should be related back to the organization's mission and the specific problem that was addressed. When they do, these benefits can be used as the basis for developing outcome measurements.

If these benefits were quantified, outcome measures can capture the actual quantities and compare them to estimates provided in the business case. If the benefits were qualitative (e.g. enhanced interaction between customers and sales persons), questionnaires or interviews can be used to determine whether they were realized.

Development of outcome measures forces the problem-solving team to be very specific about the nature of the expected benefits and when they should be realized. Depending on the project, it is generally useful to develop at least two sets of outcome measures--one to capture the immediate impact of the solution once it has been implemented, and another to capture the longer-term benefits of the project, perhaps after six months or a year.

Resources

In the implementation plan, estimates are made regarding the time and budget necessary to complete the activities that make up the solution. As each activity is completed, actual outcomes of time and other resources used for the activity should be tracked. These outcomes capture detailed information about specific costs associated with major components of the project.

In addition to evaluating the expected costs and benefits of the solution, the project team should review unexpected outcomes. In addressing problems, it is impossible to predict all consequences that might arise after implementing the solution. Thus, the problem-solving team should explore unanticipated effects relating to organizational structures, and they should survey stakeholders to explore their perceptions of and responses to the change.

Process evaluation

The final step in the Achieve stage and in the problem solving framework itself is process evaluation. Process evaluation is a critical evaluation of the decision-making process used to form the solution. Its purpose is to learn about which parts of the process in practice were effective, and how to improve the process such that problems can be solved more effectively in the future.

Problem-solving process

There are several activities that can be performed in evaluating the process. Any assessment of problem solving must begin with an examination of the process actually used in practice. This is not a restatement

of any formal problem-solving guidelines that exist in the organization or were use for the project. Rather, this is an examination of the process that was actually used to solve the problem. To do this, it is useful to consider from start to finish when the problem was first identified and all of the activities pursued in solving it.

After the actual problem solving process has been described, it can be compared to any formal problem-solving approach prescribed by the organization (such as the PSU SBA framework) to explore differences between the guidelines and actual practice. To identify these differences, those evaluating the process should revisit each stage in the problem-solving process and ask whether the guidelines were followed. For example, evaluators can ask such questions as: “Were them mission and stakeholders identified?”, “Was the analysis of the political, economic, social, and technological environments thorough and accurate?”, “Did the problem selected reflect organizational priorities?” and so forth.

Framework

When a deviation between the guidelines and actual practice are identified, it is useful to explore the purpose of the deviation and whether it was effective. Some deviations result from factors that could not have been anticipated in advance. Others arise when the formal framework is disregarded, because it is not deemed useful by problem-solvers or because the specific characteristics of the problem to be solved were inconsistent with the effective use of the framework. In both cases, is it useful to explore why the framework was not used.

When actual practice varied from that prescribed in the framework, and the outcome of that deviation was negative, this suggests a need for improvements in understanding or application of the framework. In some cases, clarification of the framework or education of problem-solving team participants can result in more faithful application of the guidelines. In other cases, resource allocations, policies and/or rewards may be necessary to ensure that the problem-solving approach valued by the organization is used by its members.

More informative in the long run are deviations from the problem-solving guidelines that result in positive outcomes. Such deviations can be a fertile source of information about the weaknesses of the problem-solving guidelines themselves. The team may fail to follow guidelines for a variety of reasons – they don’t apply to idiosyncratic problems, they are cumbersome or time-consuming, they lead to ineffective solutions, etc. When this happens, the problem-solving team should consider why the guidelines failed and if the framework should be modified to better match the framework used in practice.

Review

A final exercise in evaluating the problem-solving process is to conduct a thought experiment in which the entire process is repeated in miniature with the benefit of hindsight. Once the solution has been implemented and outcomes are known, the problem solving team can consider how the problem solving process should have been conducted to develop the best possible solution. In pursuing this experiment, the team creates its view of an ideal framework for solving the problem at hand. Just as actual practice was compared to the guidelines, the ideal framework is also compared to the guidelines. Again, the purpose is to identify deviations and use knowledge gained from them to re-create or strengthen the guidelines.

Ultimately, the organization seeks to develop the best possible set of guidelines for use in its problem-solving activities. Re-evaluating the guidelines and their application each time the process is used can help the organization develop a robust approach to problem solving that is attuned to its specific environmental and stakeholder characteristics, and that can best support pursuit of the mission.